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EXAMINER	
JERABEK, KELLY L	
ART UNIT	PAPER NUMBER
2612	

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Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	09/550,816	ANDERSSON ET AL.	
	Examiner	Art Unit	
	Kelly L. Jerabek	2612	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☐ Responsive to communication(s) filed on _____ .

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-24* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1,2,7-9,11,12,16-18 and 22-24* is/are rejected.

7)☒ Claim(s) *3-6,10,13-15, and 19-21* is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *30 June 2003* is/are: a)☐ accepted or b)☒ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

11)☐ The proposed drawing correction filed on _____ is: a)☐ approved b)☐ disapproved by the Examiner.

If approved, corrected drawings are required in reply to this Office action.

12)☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

13)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____ .

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

14)☒ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).

a) ☐ The translation of the foreign language provisional application has been received.

15)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____ .
4) ☐ Interview Summary (PTO-413) Paper No(s). _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: .

DETAILED ACTION

Drawings

1. The drawings are objected to as failing to comply with 37 CFR 1.84(p)(5) because they do not include the following reference sign(s) mentioned in the description: Page 7, line 1 " imager (10)" not in figure 1. A proposed drawing correction or corrected drawings are required in reply to the Office action to avoid abandonment of the application. The objection to the drawings will not be held in abeyance.

2.

Claim Objections

Claim 17 objected to because of the following informalities: "claim 161" should read "claim 16". Appropriate correction is required.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

Claims 1-2,7-9,11-12,16-18,and 22-24 rejected under 35 U.S.C. 103(a) as being unpatentable over Pain et al. US 6,326,230 in view of Iida et al. US 6,215,139.

Re claim 1, Pain discloses in figures 2A, 2B, 3A, 3B, and 3C a method of transferring charge accumulated in a photoactive region (6) of a pixel of an image sensor during a first period (fig. 3D: TX2 high) to a power supply node (64). See also (col. 4, lines 55-57; col. 6, lines 23-29). Pain also discloses transferring charge accumulated in a photoactive of a pixel during a second period (fig. 3D, TX high) to a sense node (54) (col. 4, lines 58-61; col. 6, lines 40-50). However, Pain does not explicitly state that the charge is transferred intermediately through a second active region for each of the two periods.

Iida discloses an image sensor (fig. 1) including a plurality of unit pixels each having two active regions (col. 4, lines 54-57). The first active region consists of a photodiode (fig. 1: 3) and a storage diode (fig. 1: 5). The second active region consists of an amplifying transistor section (col. 2, lines 28-35; col. 5, lines 14-24). A second active region is advantageous because it is an intermediate region between the photoactive region and the nodes that can be used to amplify the signal in order to reduce fixed pattern noise (col. 5, lines 55-65). For this reason, it would have been obvious to include a second active region as taught in Iida in the method of transferring charge disclosed by Pain. Doing so would ensure that the charge transferred from the photoactive region to the power supply node and sense node following pixel integration will be relatively free of fixed pattern noise.

Re claim 2, Iida states that the electric signal charge stored in the storage diode (fig. 1: 5) modulates the potential of the amplifying gate (fig. 1: 12) of the amplifying

transistor (col. 5, lines 55-65). In addition, Iida mentions that prior to photoelectric conversion the potential of the storage diode is reset at the level of the reset drain (col. 5, lines 42-47). Therefore, since the charge stored in the storage diode modulates the potential of the amplifying gate it can be seen that the amount of charge in the second active region can be set prior to transferring charge accumulated during the first period.

Re claim 7, Pain discloses a method of operating an image sensor comprising an array of pixels (fig. 1: 30; figs. 2A, 2B, 3A, 3B, 3C; col. 4, lines 39-43). The method Pain discloses consists of transferring charge accumulated in a photoactive region (60) of a pixel of an image sensor during a first period (fig. 3D: TX2 high) to a power supply node (fig. 2A: 64). See also (col. 4, lines 55-57; col. 6, lines 23-29). Pain also discloses transferring charge accumulated in a photoactive of a pixel during a second period (fig. 3D, TX high) to a sense node (fig. 2A: 54; col. 4, lines 58-61; col. 6, lines 40-50). Furthermore, Pain discloses that the transfer to the sense node occurs simultaneously for all of the pixels (col. 5, lines 22-26). However, Pain does not explicitly state that the charge is transferred intermediately through a second active region for each of the two periods.

Iida discloses an image sensor (fig. 1) including a plurality of unit pixels each having two active regions (col. 4, lines 54-57). The first active region consists of a photodiode (fig. 1: 3) and a storage diode (fig. 1: 5). The second active region consists of an amplifying transistor section (col. 5, lines 14-24). A second active region is advantageous because it is an intermediate region between the photoactive region and

the nodes that can be used to amplify the signal in order to reduce fixed pattern noise (col. 2, lines 28-35;col. 5, lines 55-65). For this reason, it would have been obvious to include a second active region as taught in Iida in the method of transferring charge disclosed by Pain. Doing so would ensure that the charge transferred from the photoactive region to the power supply node and sense node following pixel integration will be relatively free of fixed pattern noise.

Re claim 8, Pain mentions that pixel signal levels from the array (fig. 1,30) are read out one row at a time (col. 5, lines 53-58) The pixel signal level corresponds to the charge previously transferred to a pixel's sense node (col. 5, lines 56-58).

Re claim 9, Pain mentions resetting the pixel's sense node (col. 5, lines 59-61), transferring charge to the pixel's sense node (col. 6, lines 41-50), and reading out a pixel reset level corresponding to the charge most recently transferred to the pixels' sense node (col. 5, lines 53-64). However, Pain does not explicitly state that the charge is transferred intermediately through a second active region.

Iida discloses an image sensor (fig. 1) including a plurality of unit pixels each having two active regions (col. 4, lines 54-57). The first active region consists of a photodiode (fig. 1: 3) and a storage diode (fig. 1: 5). The second active region consists of an amplifying transistor section (col. 2, lines 28-35; col. 5, lines 14-24). A second active region is advantageous because it is an intermediate region between the photoactive region and the nodes that can be used to amplify the signal in order to

reduce fixed pattern noise (col. 5, lines 55-65). Furthermore, the amount of charge in the second active region can be reset to a predetermined level (col. 5, lines 42-47). For this reason, it would have been obvious to include a second active region as taught in Iida in the method of transferring charge disclosed by Pain. Doing so would ensure that the charge transferred from the photoactive region to the power supply node and sense node following pixel integration will be relatively free of fixed pattern noise.

Re claim 11, Pain discloses an image sensor comprising a plurality of pixels (fig. 1: 30; figs. 2A, 2B, 3A, 3B, 3C; col. 4, lines 39-43). Each pixel includes a photoactive region (fig. 2A: 60), sense node (fig. 2A: 54), a power supply node (fig. 2A: 64), and a controller (fig. 1: 32). The controller Pain discloses transfers charge accumulated in a photoactive region (60) of a pixel of an image sensor during a first period (fig. 3D: TX2 high) to a power supply node (fig. 2A: 64). See also (col. 4, lines 55-57; col. 6, lines 23-29). In addition, the controller transfers charge accumulated in a photoactive of a pixel during a second period (fig. 3D, TX high) to a sense node (fig. 2A: 54; col. 4, lines 58-61; col. 6, lines 40-50). However, Pain does not explicitly state that the charge is transferred intermediately through a second active region for each of the two periods.

Iida discloses an image sensor (fig. 1) including a plurality of unit pixels each having two active regions (col. 4, lines 54-57). The first active region consists of a photodiode (fig. 1: 3) and a storage diode (fig. 1: 5). The second active region consists of an amplifying transistor section (col. 5, lines 14-24). A second active region is advantageous because it is an intermediate region between the photoactive region and

the nodes that can be used to amplify the signal in order to reduce fixed pattern noise (col. 2, lines 28-35; col. 5, lines 55-65). For this reason, it would have been obvious to include a second active region as taught in Iida in the method of transferring charge disclosed by Pain. Doing so would ensure that the charge transferred from the photoactive region to the power supply node and sense node following pixel integration will be relatively free of fixed pattern noise.

Re claim 12, Iida states that the electric signal charge stored in the storage diode (fig. 1: 5) modulates the potential of the amplifying gate (fig. 1: 12) of the amplifying transistor (col. 5, lines 55-65). In addition, Iida mentions that prior to photoelectric conversion the potential of the storage diode is reset at the level of the reset drain (col. 5, lines 42-47). Therefore, since the charge stored in the storage diode modulates the potential of the amplifying gate it can be seen that the amount of charge in the second active region can be set prior to transferring charge accumulated during the first period.

Re claim 16, Pain discloses an image sensor comprising a plurality of pixels (fig. 1: 30; figs. 2A, 2B, 3A, 3B, 3C; col. 4, lines 39-43). Each pixel includes a photoactive region (fig. 2A: 60), sense node (fig. 2A: 54), a power supply node (fig. 2A: 64), and a controller (fig. 1: 32). The controller Pain discloses causes the pixels to operate in several different modes. In one mode a photocharge is accumulated in the pixel's photoactive region (col. 4, lines 44-47). In another mode, charge is transferred to the pixel's power supply node (col. 4, lines 55-57). In another mode, charge is transferred

to the pixel's sense node (col. 4, lines 58-61). However, Pain fails to teach a mode (i.e. second mode) in which charge is transferred from the pixel's photoactive region to the pixel's second active region.

Iida discloses an image sensor (fig. 1) including a plurality of unit pixels each having two active regions (col. 4, lines 54-57). The first active region consists of a photodiode (fig. 1: 3) and a storage diode (fig. 1: 5). The second active region consists of an amplifying transistor section (col. 5, lines 14-24). A second active region is advantageous because it is an intermediate region between the photoactive region and the nodes that can be used to amplify the signal in order to reduce fixed pattern noise (col. 5, lines 55-65). The second active region may be utilized in the second, third, and fourth controller modes respectively. For this reason, it would have been obvious to include a second active region as taught in Iida in the image sensor disclosed by Pain. Doing so would ensure that the charge transferred from the photoactive region to the power supply node and sense node following pixel integration will be relatively free of fixed pattern noise.

Re claim 17, Pain mentions that charge accumulated in the photoactive region during a first period (fig. 3D: TX2 high) is transferred to the power supply node, and prevented from flowing to the sense nodes (col. 6, lines 1-11). Pain also mentions that the charge accumulated in the photoactive region during a second period (fig. 3D, TX high) is transferred directly to the sense node (col. 6, lines 41-49). Therefore when the teaching of Pain is combined with the teaching of Iida as mentioned above in claim 16,

charge accumulated during the first period will be transferred through the second active region to the pixel's power supply node without passing through the pixel's sense node. Also, charge accumulated during the second period will be transferred through the second active region to the pixel's sense node.

Re claim 18, Iida states that the electric signal charge stored in the storage diode (fig. 1: 5) modulates the potential of the amplifying gate (fig. 1: 12) of the amplifying transistor (col. 5, lines 55-65). In addition, Iida mentions that prior to photoelectric conversion the potential of the storage diode is reset at the level of the reset drain (col. 5, lines 42-47). Therefore, since the charge stored in the storage diode modulates the potential of the amplifying gate it can be seen that the amount of charge in the second active region can be set prior to transferring charge accumulated during the first period.

Re claim 22, Pain states that the pixels include active pixel sensors (col. 1, lines 33-34).

Re claim 23, Pain states that the pixels include photo-gate type active pixel sensors (col. 1, lines 61-62).

Re claim 24, Pain mentions that a photocharge integration period occurs for all the pixels in the sensor at the same time (col. 5, lines 24-27). Pain also mentions all of the pixels transfer charge at substantially the same time (col. 5, lines 45-52).

Allowable Subject Matter

1. Claims 3-6,10,13-15, and 19-21 objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

2. The following is a statement of reasons for the indication of allowable subject matter: the prior art of record fail to anticipate or render obvious the following technical features as recited in the highlighted claims:

a. "...resetting the amount of charge in the second active region at substantially the predetermined level prior to transferring the charge accumulated during the second period" as recited in claim 3.

b. "...reading out a pixel signal level corresponding to the charge previously transferred to the sense node; resetting the sense node; resetting the amount of charge in the second active region substantially at the predetermined level; subsequently transferring charge from the second active region to the sense node; and reading out a pixel reset level corresponding to the charge most recently transferred to the sense node" as recited in claim 4.

c. "...obtaining a differential signal based on the pixel signal level and the pixel reset level" as recited in claim 5.

d. "...wherein setting and resetting the amount of charge in the second active region include flooding the second active region with charge and subsequently transferring charge from the second active region to the power supply node" as recited in claim 6.

e. "...setting an amount of charge in the second active region of each pixel at substantially a respective predetermined level prior to transferring the charge accumulated during the first period; and resetting the amount of charge in the second active region of each pixel at substantially the respective predetermined level prior to transferring the charge accumulated during the second period" as recited in claim 10.

f. "...wherein the controller is arranged to cause control signals to be provided to each pixel to cause the pixel to reset the amount of charge in the pixel's second active region at substantially the predetermined level prior to transferring the charge accumulated during the second period" as recited in claim 13.

g. "...wherein the controller is arranged to cause control signals to be provided to each pixel to cause the pixel to: read out a pixel signal level corresponding to the charge previously transferred to the pixel's sense node; reset the pixel's sense node; reset the amount of charge in the pixel's second active region substantially at the predetermined level; subsequently transfer charge from the pixel's second active region to the pixel's sense node; and read

out a pixel reset level corresponding to the charge most recently transferred to the pixel's sense node" as recited in claim 14.

h. "...wherein the controller is arranged to provide the control signals to each pixel so that all the pixels transfer the charge accumulated in the their respective photoactive regions during the second period at substantially the same time" as recited in claim 15.

i. "...wherein the controller is arranged to cause control signals to be provided to each pixel so that an amount of charge in the pixel's second active region is set substantially at the predetermined level prior to causing the transfer of charge accumulated during the second period from the pixel's photoactive region to the pixel's sense node" as recited in claim 19.

j. "...when each pixel includes a reset switch, and wherein the controller is arranged to enable the reset switch to reset the pixel after a pixel signal level is read out" as recited in claim 20.

k. "...wherein the controller is arranged to cause control signals to be provided to each pixel after the pixels are reset so that an amount of charge in each pixel's second active region is set substantially at the predetermined level, and subsequently to cause bias signals to be provided to transfer a pixel reset level from each pixel's second active region to the pixel's sense node" as recited in claim 21.

Conclusion

The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

Merrill et al. (US 6,002,432) discloses a method for operating an active pixel sensor cell that reduces noise in the photo information extracted from the cell.

Prentice et al. (US 6,069,377) discloses an image sensor incorporating saturation time measurement to increase dynamic range.

Pain et al. (US 6,380,572) discloses silicon-on-insulator active pixel sensors with the photosite implemented in the substrate.

Merrill et al. (US 6,130,713) discloses a CMOS active pixel cell with self reset for improved dynamic range.

Contacts

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Examiner Kelly Jerabek whose telephone number is (703) 305-8659. The examiner can normally be reached on Monday - Friday (8:00 AM - 5:00 PM).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's primary examiner, Wendy Garber can be reached at (703)-305-4929.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 703-305-4700.

The fax number for submitting all Official communications is (703) 872-9306.

The fax number for submitting informal communications such as drafts, proposed amendments, etc., may be faxed directly to the Examiner at (703) 746-3059.

KLJ

VU LE
PRIMARY EXAMINER